BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	MB Docket No. 02-230
Digital Broadcast Content Protection	)	

REPLY COMMENTS OF:

AEREAL INC., BAUHAUS SOFTWARE, BITFONE CORPORATION, BLOSSOM RESEARCH ("GNU RADIO PROJECT"), CEDX CORPORATION, DAMAGE STUDIOS, DANDIN GROUP, FEEDSTER, GIBEO LLC, LULU ENTERPRISES, INC., MY SQL, PEAK INTERNET, SLIM DEVICES, SOCIALTEXT, SOLARI, INC., SPUTNIK, STONEBRICK GROUP, TED ROCHE & ASSOCIATES, LLC, WEMATTER.COM, WHIZSPARK CORPORATION, AND WIFINDER ("THE TECHNOLOGY COMPANIES")

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Aereal Inc., Bauhaus Software, Bitfone Corporation, Blossom Research ("GNU Radio Project"), CEDX Corporation, Damage Studios, Dandin Group, Feedster, Gibeo LLC, Lulu Enterprises, Inc., My SQL, PEAK Internet, Slim Devices, SocialText, Solari, Inc., Sputnik, Stonebrick Group, Ted Roche & Associates, LLC, WeMatter.com, WhizSpark Corporation, and WiFinder hereby submit these reply comments in connection with the Commission's *Report and Order and Further Notice of Proposed Rulemaking,* FCC No. 03-273 (Nov. 4, 2003) ("*FNPRM*") in the above-captioned proceeding.[1]

I. INTRODUCTION

We write to urge the Commission to protect to the fullest extent possible the interests of innovators and innovation as it moves closer to a Final Order.

The explosive wealth and job creation this country experienced during the past decade was due to a technological, legal and regulatory framework that made innovation cheap and easy and the tools for it available to any entrepreneur with a few skills and a great idea. Right now, in contrast, financing for new ideas is limited, jobs are quickly moving overseas, and innovation is stymied. With luck our current circumstances will be temporary. But elements of the proposed Rule, and some of the suggestions made in the comments, would help freeze our current low rate

[1] "Assistance in preparing this filing was provided by Jason Gelman, Caleb Groos, and Lisa Vatch with Duke Law School's Center for the Study of the Public Domain."

of innovation in place. In fact, some elements of the proposed Rule would completely cut off some of the most promising areas of software research and innovation—particularly in the areas of proprietary and open-source content management, software demodulation, and after-market modifiable software—and decimate current efforts to advance other general purpose computing techniques.

This will result in significant harm to innovation and to the US economy, based on mere speculation of harm by industries with an obvious interest in stifling new technologies that threaten their current business plans.

The Commission should not be in the business of picking and choosing industry winners and losers. We urge the Commission to resist efforts to use this proceeding to alter the boundaries of legal protection for digital television content, and ask that the Commission instead adopt a Rule that protects and promotes innovation.

II. THE COMMISSION SHOULD NOT ADOPT A RULE THAT LIMITS CONSUMERS' FAIR USES OF DIGITAL TELEVISION CONTENT AND INHIBITS COMPANYS' ABILITY TO DEVELOP TECHNOLOGIES TO ENABLE THESE USES.

While the evidence of harm to television content owners is merely speculative, the evidence of innovative opportunities in this area is concrete. Feedster, which built a search engine "which is to blogs what Google is to Web sites," according to the Wall Street Journal, enables quick distribution of digital video content.[2] Through Feedster, users can find current video clips that might take days or weeks to locate through traditional search technology. Feedster's technology comes at an apt time; digital video is becoming an ever-more-important part of American civic discourse. Key moments in history, visually recorded, have special importance in our national culture, and the Commission should protect the efforts of companies like Feedster to make those moments available in new and innovative ways.[3]

We cannot state for certain what a court would think of the use of this content— but this use is almost certainly fair. Copyright law grants content creators and owners certain rights to control the distribution and use of their work. It also permits some uses of works without the owner's permission by consumers for purposes like comment, criticism, etc. Fair use is not determined by the copyright owner, but by a court after the use occurs. Only then can a court

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[2] "Blogs" -- shorthand for Internet weblogs -- are a form of online publishing that permits thousands of individuals to discuss new issues and ideas in a flexible and accessible form.

[3] Examples of especially important "video moments" include the Zapruder film of the Kennedy assassination, videos of the Berlin Wall falling, or the infamous footage of the September 11 attacks. All those videos were (and are) protected by copyright -- but few would defend the validity of a copyright protection scheme that denied the public access to them for civic discourse purposes.

determine the nature of the work, the use made, the amount copied and whether the use interferes with the market for the original work, all factors in the fair use test. While some of the criteria for performing that analysis have been codified in the copyright statute, or can be gleaned from reading court decisions that address fair use, this is *always* a post hoc decision by a court—made after a specific use occurs (or is proposed, such as in a declaratory action suit). To do otherwise is to give the copyright owner the ability to issue an absolute prior restraint on fair use works.

Any rule issued by the Commission that prevents users from making copies of digital broadcast content completely redefines the balance between copyright protection and public rights of access. It also prevents the development and dissemination of technologies like Feedster's search engine, innovation into other means for quick search and dissemination of excerpts from digital content whose fair use fosters and informs public debate, and research into other means for using digital broadcast content in manners traditionally approved by the courts.

A. <u>This Rulemaking Is Not The Appropriate Venue For Redefining Substantive Copyright Law.</u>

We agree with the other commentators that whatever steps the Commission takes, it must operate within the boundaries of copyright law. This rulemaking is not the proper venue for redefining the scope of copyright protection for digital television. This has been one of the mainstays guiding the Commission's efforts in this matter, and we urge you to keep this objective in mind.

Adoption of a standard for digital television content protection cannot be driven by a desire to mandate technologies that prevents *all* uses of content. This will *per se* alter the scope of copyright protection currently afforded television content—while we know for certain that consumers have the right to time- shift (and space-shift) TV content, we do not know what other uses Court's will allow until they have the opportunity to rule on them.

Whether the nature of digital content means that consumers' fair uses of digital content will be more limited than their fair uses of analog content is a question for the judicial branch of government, may be a question for the legislative branch (subject to a determination by the court that the answer does not interfere with the First Amendment), but is certainly not a question for an executive branch agency—especially not one without an express mandate to create copyright rules.

We urge the Commission not to endorse a technological regime that makes normative determinations about the balance between copyright owners interests and consumers' interests, (sometimes referred to as a "judge on a chip"), especially in the absence of a judicial or Congressional mandate in favor of that rebalance. The Commission should allow Congress and the courts to continue to evaluate the interaction between technological protection measures for copyright protection and the fair uses allowed content consumers.

B. Fair Uses Are Determined By A Court After A Use.

A major theme running through the comments submitted by members of the content industry is that the Commission would be altering the boundary of copyright law if it *allows* viewers to use or distribute digital television in any matter not *expressly permitted by a court or statute*. This is not a correct statement of the law. The major change to the boundaries of copyright law would come if the Commission *prevents* all non-explicitly permitted uses.

1. Effect on the market is not the only element of a fair use analysis.

In their comments in response to the *FNPRM*, a coalition of professional and collegiate sports organizations (hereinafter "Sports Organizations") state their concern that widespread distribution of live and tape-delayed sporting events may have a serious negative effect on the market for this content—but they fail to state that effect on the market is *only one* element of the fair use analysis. It is not the province of the FCC to make this determination. It is irrelevant under copyright law whether owners agree to *allow* fair use of their digital TV broadcast or not. Fair use is, by definition, permissible use regardless of the copyright owner's preferences. Every single use a Court has protected, a copyright owner first claimed was an infringement. It has always been the province of the judicial system to determine whether a certain use of content is permitted to satisfy fair use concerns and First Amendment concerns.

2. Geographical proximity of a copy is irrelevant to a fair use analysis.

There is absolutely no basis in the law for limiting distribution of digital broadcast content to geographically close devices. Today's society is increasingly mobile, and devices for accessing and viewing content are increasingly portable. If the Commission uses geographical proximity as a factor to limit where and how copies will be made, it will be creating out of whole cloth a new element of the fair use analysis and decimating innovation in a major new products American companies are anxious to roll out.

In their comments, the MPAA and movie studios (hereinafter "Movie Comments") argue that the scope of prohibited distributions should be limited to the local environment. They propose certain mechanisms by which the local environment be defined and note their interpretation of types of content distribution that will and will not fall under this geographical standard. The "Sports Comments," reject the notion of a "personal digital network environment" because they fear it may "go beyond localization" thereby interfering "with copyright law definitions of exclusive rights pertaining to performance and distribution" and "significantly impair if not render impossible the efforts of copyright owners to protect those rights by technological means."

This is not a correct statement of the law. Nowhere does copyright law approves copies made "near" the original but not "far away." The law looks to the nature of the copy, not where it was made. The Commission should acknowledge that in a mobile, always-on society, a users 'personal digital network environment' has no relation to geography, certainly not to where their television is located, and reject any effort to limit consumer uses of digital broadcast content by location and accept

C. Analog Content is Not Sufficiently Comparable To Digital Content To Justify This Unwarranted Rebalancing.

Availability of digital content is what spawned our industry, fed its explosive growth, and will be responsible for the next boom. Availability of content via the "analog hole" is irrelevant and useless to companies that want to build products that manipulate and transfer content. We understand that creators of digital television are concerned that digital distribution makes infringement easier. But racing to alleviate their concern without concrete evidence of any harm hinders our efforts to build new technologies for consumers to manipulate content in all the ways courts do allow—create parodies, reuse clips, etc.

In the entire history of copyright law there has never been a rule that grants absolute control over one type of content just because comparable content is available in another form. . This is a massive change for the Commission to impose based on mere assertions by the content industry, especially in light of burgeoning major research initiatives in the technology industry. Fair uses by students, libraries, researchers, documentarians, start-ups, and innovators of all types should not be ghettoized to analog content.

III. THE COMMISSION SHOULD PROTECT INNOVATION BY INTERPRETING ITS ROBUSTNESS STANDARD LIBERALLY.

The "ordinary user" robustness standard selected by the Commission crucially and correctly recognizes that innovation in content protection is best promoted by flexibility. But protecting innovation and consumer uses requires that this standard be fleshed out in equally-crucial ways. As the Commission considers how it will interpret it's rule when selecting the standards and procedures for approval of content protection technologies, it should keep three key considerations in mind: first, the "ordinary user" standard is actually a two-pronged standard encompassing both users' skill level and their intent in making use of DTV content; second, the "ordinary user" standard does not require that a technology be completely unmodifiable by end users; and third, the "ordinary user" standard must be construed as creating a level playing field for all content protection technologies, including software-based and open-source technologies.

A. The "Ordinary User" Standard Is A Two-Pronged Test, Encompassing Both An Ordinary User's Skill Level And An Ordinary User's Intent.

The "ordinary user" robustness standard should be read and implemented as a two-pronged test. In order to promote innovation in content protection technologies and new consumer uses, the test should require that each content protection system display robustness before users who 1) have an ordinary level of computing skill, and 2) have ordinary intent and expectations regarding use of DTV content. Such a reading is required for four reasons.

1. The plain language of the term "ordinary user" implies a two-pronged test.

First, the Commission's straightforward phrasing—the compound phrase "ordinary user" instead of "expert"—implies that the robustness will be measured against a user 1) of ordinary skill, 2) using the system in an ordinary way.

The rejected "expert" standard was more precisely an "expert attacker" standard that incorporated two distinct parts: it would have tested robustness against a user 1) of "expert" skill, 2) attacking the system. Because it emphasizes use instead of attack, the "ordinary user" standard crucially acknowledges that most users are not attackers. Had the Commission sought to be less accepting of users' reasonable expectations, it could have adopted an "amateur attacker" or "unskilled attacker" standard.

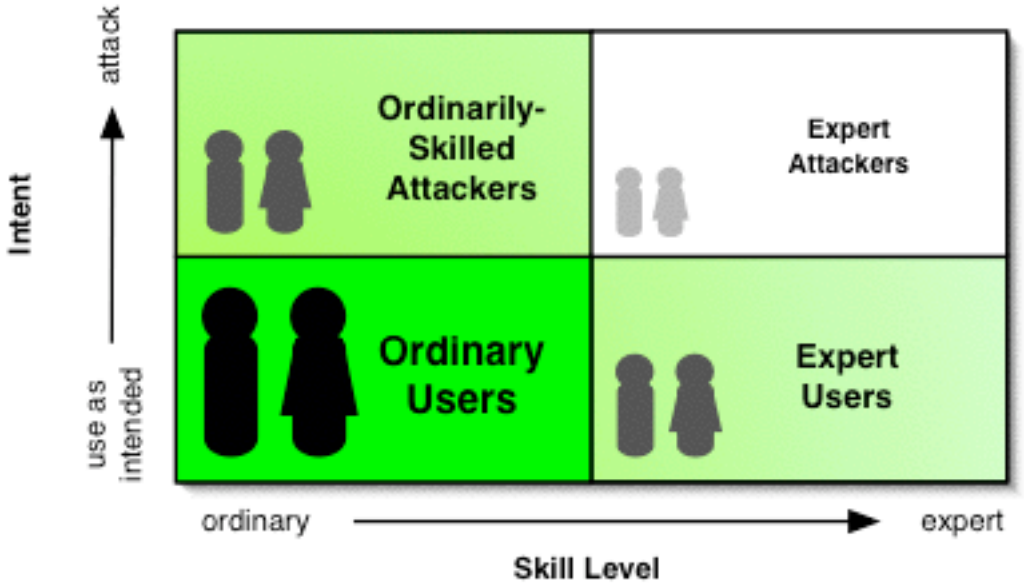

Figure 1 - Intent & Skill Level in Robustness Standards

There is no reason to assume that all, most, or even many consumers are 1) highly skilled, or 2) inclined to "break" copy protection systems. The "ordinary user" standard demands that technologies show robustness before most users—not a minority population of outliers. That goes for both most users' skill level (non-expert) and most users' intent (to make reasonable uses of DTV content).

The Commission has stated that a major goal of the broadcast flag is to avoid excessively restricting consumers' uses of lawfully-acquired digital content.[4] It is difficult to see how such an

[4] "We also wish to clarify our intent that the express goal of [the flag regulation] . . . be to *prevent the indiscriminate redistribution of [protected] content over the Internet or through similar means.* . . . It is our belief

appropriate goal would be achieved by presuming that every consumer use is an attack and every user an attacker.

2. Failure to incorporate a two-prong test would destroy the meaning intended by the Commission.

Second, the "ordinary user" standard must include a prong focused on "ordinary intent" in order to maintain its meaning. If "ordinary user" were taken as synonymous with "attacker of ordinary skill," the standard would collapse back to the "expert" standard already considered and rejected.

Modern technology makes a distinction between "ordinary" and "expert" attackers unsustainable. It takes only one "expert" attacker to break a content protection system, and innumerable "ordinary" attackers can learn his technique.[5] Opponents of consumer freedom would attempt to force the Commission to concede that robustness against ordinary attackers must encompass the fact that even unskilled attackers could apply expert-level techniques to disable a content protection system.

But by requiring that robustness be measured against ordinary use rather than ordinary attack, the Commission has already stated that its "ordinary user" standard should not collapse into an "attacker" standard. It must now clarify its meaning so as to avoid any future misinterpretation.

3. Failure to apply a two-pronged standard would inappropriately make the Commission the final arbiter of intellectual property rights in digital TV.

As described above, the Commission has repeatedly made clear that questions of copyright law must be left to those bodies where they can properly and legitimately be resolved – most notably, Congress and the courts.

These entities have taken users' purposes in copying into consideration when setting policy; the Commission must not intrude on the other branches' authority to make such determinations.[6] The

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that [approved content protection] technologies can protect content *while facilitating innovative consumer uses and practices*[.]" (emphasis added) Report and Order and Further Notice of Proposed Rulemaking, *Digital Broadcast Content Protection*, M.B. Docket No. 02-230, FCC 03-273 (rel. Nov. 4, 2003) ("Broadcast Flag Order") ¶ 10.

[5] Compelling examples of this can be seen in the "cracking" (and subsequent distribution of tools/instructions for replicating the crack) of content protection systems such as CSS (used to protect DVDs), Windows Media Player (used for digital sound and video content), and the hardware protection applied to Sony's PlayStation 2 video game console.

[6] Some copyright laws -- such as the Digital Millennium Copyright Act's anticircumvention provisions -- do not make allowance for users' intent in copying material. But this provision has been highly controversial. As an acknowledged departure from the traditional boundaries of copyright protection, its contours continue to be defined by the courts. In any case, it is important to acknowledge that DMCA was a Congressional enactment, not a

Commission can minimize its entry into this issue by emphasizing flexibility, not rigidity, in its standards, and leaving the detailed interpretation of copyright duties to the appropriate bodies. The flag must not be permitted to become *de facto* copyright regulation, enforced by technology rather than the courts.

If the Commission fails to adopt a flexible, two-pronged standard, it will find itself the focus of a maelstrom of dispute over each and every new content protection technology that a company wants the Commission to approve. Content owners and consumer advocates will appear before the Commission just as they do before courts today, each to plead their legitimate interests and to request a favorable ruling. This would unduly burden the Commission and undermine the goals of the flag regulation.

4. Failure to apply a two-pronged standard would impair innovation in content technologies and empower users.

Fourth, only a reading of the "ordinary user" standard that encompasses both the skill level and intent of most users would continue to allow the kind of acclaimed innovation already seen with new digital distribution technology. The iTunes Music Store—*Time*'s Invention of the Year for 2003—provides an instructive example.[7] iTunes' software-based DRM technology permits users to share purchased music with up to three computers and burn any playlist to CD up to ten times. Viewed against a one-pronged standard requiring robustness against "ordinary attackers," the iTunes Music Store would almost certainly fail to achieve certification, as iTunes permits even novice users to create an unprotected copy of their music by burning to CD.

But iTunes has not contributed to music piracy. Though users have the requisite ability, the vast majority of users have no desire to threaten copyright owners' interests. The iTunes software disincentivizes users from piracy by erecting subtle social barriers to music sharing.[8] iTunes' success is a testament to the ability of copyright owners to thwart piracy while adopting a distribution scheme that does not prohibit all copying. This type of innovation and creativity would be lost if the Commission fails to adopt an "ordinary user" standard.

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regulatory order, and any attempt to regulate is such a broad manner would be the proper province of Congress, not an executive agency without mandate to address copyright interests.

[7] Chris Taylor, *The 99 [cents] Solution*, Time, Nov. 17, 2003, at 66.

[8] For example, a user who wants to share iTunes music content on a peer-to-peer file sharing network would need to burn the content to an unencrypted CD, then re-import it into the computer using unprotected MP3 technology – a process taking about fifteen minutes (and one blank disc) per album and resulting in a loss of audio quality. While the "costs" of this process seem low at first glance, they are actually effective barriers to music piracy. There is no evidence whatsoever that the iTunes Music Store has significantly contributed to the piracy problem. Indeed, iTunes' approach has been so effective that other online music ventures are mimicking its method of using "social engineering" rather than restrictive DRM to protect against music piracy.

The Commission should acknowledge the import of its own language, the importance of maintaining its chosen standard, the need to avoid creating *de facto* copyright law, and the value of innovative "social engineering" approaches to content protection by interpreting the "ordinary user" standard as a two-prong test: approved technologies must be robust enough to resist being compromised by users with 1) an ordinary degree of skill, and 2) ordinary intent as to their use of digital content.

B. The Commission Should Establish That Modifiability Will Not Be Taken As *Prima Facie* Evidence Of A Technology's Non-Robustness.

The "ordinary user" standard should mean that, though a technology may be modifiable after-market, this possibility will not be an unfair bar to approval. Such an interpretation is crucial if software-based content protection is to have any role in the DTV environment.

Software- based systems may be deployed on a wide array of general-purpose computing machinery. Besides the fact that they can run on systems that consumers already own and their short product cycles encourage rapid innovation, software systems create special value for consumers as they can be modified after purchase to create new features or capabilities.[9] To ensure that this vitality continues, the Commission must make clear that the "ordinary user" robustness standard does not prohibit *any* modification of acquired software by ordinary users. An outright ban on users' ability to modify the products they acquire would penalize consumers by denying them the ability to exploit one of software systems' greatest values.

End users are able to modify software products in ways that the original developers did not foresee, but which create extra value. [10] Once developed, useful modifications can rapidly become accessible by all users, either in the form of detailed instructions or as executable software. After-market modifications have become a key innovations in many software systems; tools exist that permit users to extend commercial software to help them find new music to purchase, to interact with video games in new ways, or to run software on platforms other than those for which it was designed. Many of these innovations have found their way back into the proprietary world as new features for later versions of software.

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[9] Some hardware systems have proved amenable to after-market modification as well. For example, many users have modified their TiVo Personal Video Recorders to increase storage capacity or add new features. See, e.g., Jeff Keegan, *Hacking TiVo: The Expansion, Enhancement, and Development Starter Kit* (2003). But because hardware modification can require specialized tools and skills, easy modifiability is often considered the province of software tools.

[10] In Internet parlance, these modifications are referred to as "hacks." Despite the negative treatment some have given the term, a "hack" is properly defined as "a quick fix to a computer program problem. . . . The surface implication was a casual attempt to fix the problem, but the deeper meaning was, often, something more clever and thus impressive." "Hack," *Wikipedia: The Free Encyclopedia*. Available at http://en.wikipedia.org/wiki/Hack. Today, there are dozens of online repositories dedicated to promoting and preserving the art of "hacking" as it was originally construed, ranging from "hacks" of computer software to those of everyday items. *See* "hacks.oreilly.com," available at http://hacks.oreilly.com/,

Moreover, an "unmodifiable" standard may be unattainable for any software product. Software can be designed to resist modification, but no software can ever achieve 100% protection against modifiability.[11] The Commission must resist any notion that software could be "bulletproof" with regards to aftermarket modification by ensuring that its robustness standard takes a flexible approach. Some designers may choose to make such resistance part of their scheme to protect DTV content, and the Commission should take such efforts into account. But an inflexible standard— that software must be non-modifiable by end users— could close the door on all software products.

C. In Considering Robustness, The Commission Should Promote A Level Playing Field For All Software, Including Free And Open-Source Software.

Software robustness does not depend on whether it is open or closed source. Though creating an open-source content protection system of the kind envisioned by the flag would be difficult, it is not impossible, and the Commission should not close the door on attempts to do so. To that end, protection systems should be judged on their merits in the form that users would actually use them.

1. Open-source and free software are an important trend in modern software design.

As the Commission knows, a large and growing amount of high-quality software is being created through open-source development. When project source code can be reviewed and updated by a global community of developers, evolution is accelerated and innovation flourishes. Extremely powerful software has been created in this fashion.

2. Robustness is an aspect of design, not development process.

Despite open-source software's unique development method, claims that open-source software is inherently "less robust" than that generated in a more closed environment are wrong. Robustness is produced by design, not development process. The fact that a project is open source may complicate the question of whether such a project could adequately protect content.[12] However, just because it is difficult does not mean the Commission should bar it entirely. The open-source development community has a surprising record of innovation, and the Commission should adopt standards that it can meet.

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[11] When software is made available only in its compiled form, it sometimes must be reverse-engineered before modification is possible. Such reverse-engineering is difficult, but not impossible, and software makers have many tools at their disposal to make it more difficult still.

[12] The difficulty stems from the fact that, unlike other forms of security where open-source software has excelled (whereby content can be protected against third-party eavesdroppers), the flag regulation seems to require that unencrypted content be secured against the end user herself. Using current methods of encryption, it is difficult to see how an open system could be robust in such a circumstance.

3. Availability of source code will not affect robustness for "ordinary users."

For the ordinary user, raw source code is not of much use. *Only when the source code is compiled into an executable format and then distributed does it become useful to ordinary users.* This is true for both open- and closed-source software projects. While compiling a program is by no means as difficult as creating a program from scratch, the act requires both skill and specialized compiling tools that are not part of the average American's computing experience. [13]

In order to give open-source software a level playing field in the content protection arena, the Commission should provide that the robustness of *all* software protection technologies will be evaluated only in the software's post-compiled form.

IV. THE COMMISSION SHOULD NOT REGULATE SOFTWARE-BASED DEMODULATION TECHNOLOGIES BECAUSE IT WOULD UNREASONABLY PREJUDICE OPEN-SOURCE SOFTWARE DEVELOPMENT, WOULD HINDER INNOVATION, WOULD BE ANTICOMPETITIVE, AND IS UNJUSTIFIED BY CONCRETE ALLEGATIONS OF HARM.

A. Regulation Of Software-Based Demodulation Products In Effect Bans "Open" Software Development In A Crucial Area Of Technology Development.

Open-source projects such as GNU Radio would cease if the Commission fails to properly limit the reach of the broadcast flag regulation. The flag regulation's basic premise – that any device performing both signal demodulation and transport stream processing of DTV content must incorporate an approved content protection technology – would be an absolute bar to further open-source research in this area. If, at some point in the future, evidence of software demodulation's growing popularity begins to implicate concerns about protecting DTV content, the Commission may consider regulation. It should not do so in the absence of such evidence.

1. The open-source development process is a linchpin of the effort to develop new technologies for manipulating electromagnetic signals.

The effort to create innovative, efficient systems for utilizing the limited electromagnetic spectrum is of great national importance. The Commission's ongoing proceeding on Cognitive Radio makes prominent note of the myriad consumer and commercial benefits that will flow

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[13] As the state of the art proceeds, tools for easy compiling of source code are likely to become available. Compiling may come within reach of the "ordinary user." At the moment and for the foreseeable future, these tools either do not exist or are not widely used; the number of users who actually compile source code is small and expert. The Commission should not regulate against open-source software based only on the prospect that this class of users may become larger and less specialized.

from new technology in spectrum allocation and management. But unless its reach is carefully cabined, the broadcast flag regulation threatens to drastically undercut progress in this area. By its nature, the flag is incompatible with one of the most prominent tools used by developers seeking to explore new frontiers in spectrum utilization – the open-source development process.

Just as it has for other transformational technologies, the open-source development method is helping to foster innovation for spectrum utility.[14] Projects such as GNU Radio (a prominent software-demodulation project managed and chiefly staffed by comment author Blossom Research) have already begun to demonstrate how, by adding general-purpose signal reception hardware to consumer-level PCs, users can deploy the computational power of modern computing systems to explore new innovations in radio spectrum technology. As the Commission knows, GNU Radio has already begun to break down the barriers separating computing technology from other forms of communication. Soon, computer users may be able to receive and manipulate wireless signals with the same facility that they currently manipulate the digital data they store on their hard drives or receive through their modems and network cards. While the full impact of GNU Radio and other open-source projects is difficult to predict, it will probably first bring tangible benefits in the area of convergence – enabling a single device to perform numerous useful functions – and in wireless connectivity. GNU Radio also has exciting prospects to help reshape the very design of network communications, encouraging the movement from rigid, centralized communications infrastructures to more adaptive, decentralized systems like the Internet itself.

It is impossible to separate the GNU Radio project's rapid progress from its open-source development process. As the Commission knows, wireless signal manipulation is an extremely complicated process, usually requiring professional expertise and skilled hardware. By combining the efforts of dozens of developers worldwide, the GNU Radio project has brought the process within reach of ordinary users using off-the-shelf hardware. Most importantly, GNU Radio has made its accomplishments *freely available to the world* – an act of generosity that will eliminate any need for future developers or product designers to reinvent the wheel of software-based signal manipulation.

2. Open-source development in this area cannot continue in the context of regulation by the Commission.

Applied to the open-source development process, the flag regulation would attempt to reverse the usual order of software development. Unlike proprietary products, open-source software projects are "in distribution" from the day the project is conceived. Under the flag regulation, this would mean that an open-source project aimed at demodulating DTV signals would need to

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[14] In recent years, open-source development has played a key role in the emergence of invaluable technologies such as computer networking, e-mail, public key encryption and the World Wide Web.

incorporate an approved content protection technology *first*, and actually build the demodulation project *second*. Even were such incorporation possible for an open-source project, it would require open-source developers to predict what the functional form of their project will look like and how it will behave before a single line of code has been written – an absolute impossibility.

Even if open-source developers were able to predict their project's behavior from the outset, there is no reason to believe that licensors of approved content protection technologies would consent to seeing their technology incorporated into open-source projects. In fact, there is every reason to believe the opposite. All the content protection technologies mentioned by commenters to date are *per se* incompatible with incorporation into open-source projects. Some, like 5C, require extremely tight control over device keys and encryption algorithms in order to maintain their security. Others, like Microsoft's well-known Windows Media Player, are highly-valued products whose code is unlikely to ever be made public. Of course, the licensors of these technologies must speak for themselves as to whether they would permit the technology to appear in open-source projects, but there is every reason to expect that they would decline – and they would be within their legal rights to do so.[15]

Some commenters have claimed that software demodulation research could continue so long as developers' ability to focus on the areas of spectrum and types of signals used for DTV is constrained.[16] Such an approach would be counter to the very purpose of GNU Radio and other software-controlled radio systems, which is to create unity in our technological treatment of radio signals—not enforce barriers. The Commission should not constrain research in this area by instructing researchers to swear off demodulation of certain signals on the public airwaves. And it should certainly not do so where the signals in question carry "free over the air broadcast TV."

Finally, the Commission has received comments likening the broadcast flag regulation to previous regulations such as the V-Chip regulation.[17] These analogies are misplaced. Such regulations were promulgated to ensure that finished products would serve public policy goals such as parental control over children's viewing habits or closed-captioning. They were never intended to terminate entire fields of development. Moreover, their effect is drastically different from the effect of the broadcast flag in that their terms are easily reachable by developers. A software demodulation project can easily implement "V-Chipping" or closed captioning on its

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[15] As mentioned *supra*, there is a chance that open-source developers could create a content protection technology capable of adequately securing content against indiscriminate use. The task, however, is difficult -- far more difficult for open-source developers than for closed-source ones. Given the obvious usefulness of software demodulation technology and the difficulties involved in open-source content protection, the Commission should not force GNU Radio and other projects to go "on hold" pending resolution of a problem that may never be solved.

[16] *See* Comments of the MPAA at 14-15.

[17] *Id.* at 15-16.

own—but it cannot implement content protection without a license from an approved content protection technology. Thus, application of the flag to software demodulation would not have the effect that all open-source software demodulators would protect content; it would have the effect that there would be no open-source software demodulation at all.

The Commission should appreciate that applying the flag regulation to open-source software projects would be a death sentence for a vibrant field of research in a nationally-important area. If the Commission does not wish to see these projects terminated, it should consider limiting the flag's application.

B. Prejudice Against Open-Source Software Is Unjustified By Any Concrete Allegations Of Harm.

The Commission's appropriate goal for the flag regulation is securing against indiscriminate online sharing of digital broadcast content. But it is difficult to see how this goal will be served by regulating a technology for which there is not only no evidence of indiscriminate sharing, but of *any* sharing, and almost no chance at all that such sharing would ever become an issue.

For example, for a hypothetical pirate bent on finding an efficiently producing unprotected digital copies of DTV, GNU Radio would be not be a very time-effective technology choice. In its current form, GNU Radio requires about ten hours of computation to yield one hour of playable DTV.[18] The data files it creates are immense, over 30 GB per hour of digital video. Moreover, software demodulation requires equipment beyond what is packaged with a consumer-level PC. It requires an advanced analog-to-digital converter capable of transforming the received radio signal into a digital form suitable for signal processing. Such a device presently costs $1,300 – more than most consumer PCs. With such system requirements, it is hardly surprising that software demodulation has not become a popular consumer activity, even among the relatively small niche of technically-minded consumers. It has certainly not contributed to indiscriminate file sharing.

[18] This is due to the immense amount of data carried in the DTV broadcast signal. For other types of radio signals, GNU Radio is far speedier -- for example, GNU Radio can receive and play an FM radio signal in real time, or even several signal simultaneously.

C. Prejudice Against Open-Source Software Development Is Anticompetitive And Unreasonably Favors Proprietary Computing Platforms Over Free Ones.

1. Open-source and free software contribute substantial value to the national economy.

Open-source software is internationally renowned as both highly secure and high quality. The open-source development process has become a mainstay of the operating system market because open development has makes bugs easier to fix, security vulnerabilities easier to detect, and high efficiency easier to achieve. Many are aware of the great strides made by the GNU/Linux operating system, which has become a key feature of the server (and, increasingly, desktop) operating environment.[19] Open-source development also plays a prominent role in Apple's OS X operating system. Apple opened the source code for a crucial part of OS X—the kernel, named "Darwin"—in order to help its OS X product benefit from the same kind of innovation and attention that GNU/Linux had.[20]

Open-source software is not limited to the operating system environment. Much of the software at the Internet's core was developed through open-source processes, including Apache (web server), sendmail (e-mail routing), BIND (domain name serving), and OpenSSL (encryption).

Open-source software is also making inroads into the consumer environment. Besides Apple's OS X operating system, open-source technology has been applied in video compression (DivX), audio compression (Ogg Vorbis), web browsing (Mozilla), photo manipulation (GIMP), and office productivity software (OpenOffice.org). These tools are both innovative and capable, and empower users in important ways.

Many of these technologies carry the added advantage of being freely available to any interested user. This has had a significant egalitarian effect, permitting any user with a personal computer to gain access to powerful computing technologies. Indeed, open-source software has become so appealing in many contexts that it has begun to be aggressively adopted not only in the private sector, but in the public as well. An increasing number of national, state, and local governments have begun moving towards open-source systems.

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[19] This operating system is sometimes colloquially referred to as simply "Linux;" the "GNU/Linux" appellation more precisely acknowledges that the Linux project is one component (the "kernel") of an operating system that requires other components (collectively, "GNU") to run.

[20] The full operating system, OS X, is not itself an open-source software project. But, as the GNU/Linux example shows, the kernel of any operating system is a crucially important component; by open-sourcing Darwin, Apple has opened a major part of OS X to public scrutiny.

2. Open-source and free software enhance competition in the IT market.

Of course, these capable open-source products usually share the market with equally-capable closed-source products, creating a competitive atmosphere that benefits consumers. When the open-source products are made freely available, competition is even more intense. Makers of closed-source software simultaneously have the opportunity to both learn from open-source software and to compete against it, making newer and better products for everyone to use. Without the competitive energy provided by open-source technologies, these markets would be less vibrant. Some might stagnate entirely.

Innovative companies capitalize on the free movement of ideas within the open-source community to create new markets. For example, SocialText, an author if this filing, can be thought of as having a "hybrid open-source business model." A maker of enterprise social networking software, some of SocialText's offerings use closed-source development, while others are open-sourced to the community. By becoming an active participant in the open-source environment, SocialText has been able to identify and implement new ideas from the community into creative new product offerings. Moreover, SocialText is embracing a new model of software production and distribution in which even software being actively used by a client can evolve over time, keeping up with the "cutting edge." Innovation of this kind requires a vibrant open-source movement to move forward.

3. Protecting open-source and free software in these areas will enhance innovation and competition.

Unless its reach is limited, the broadcast flag regulation will have one very prominent effect—it will ensure that the benefits of open-source development are never realized in the DTV or signal demodulation environments. In the face of Commission regulation, no open-source project—many of which are entirely volunteer efforts, with little or no institutional backing—would be able to get off the ground. It would be incongruous for the Commission to permit (and in fact cause) these markets to stagnate while at the same time the Commission is taking every effort to *promote* innovation in other contexts. The Commission should not permit this to occur.

D. Regulation Of Open-Source Software Will Be Ineffective And Will Only Put American Software Developers Behind The International Curve.

Open-source software development is too useful for other nations to forgo it in the face of American regulation. If the Commission approves the flag in its current form, open-source work on software demodulation and other technologies will cease only for Americans. Work will continue in this area overseas, with participation from many nations—but not the United States.

With open-source products of this kind being developed overseas, determined copyright infringers will find their access to them only minimally disrupted. The Commission's regulation will be a substantial bar only to those consumers and software developers who wish to use the

technology for lawful purposes. Extension of the flag to cover software demodulation would thus impair "ordinary users" and the nation's software economy, while achieving little in the way of online security.

V. CONCLUSION

Regulating technology is always difficult because it advances certain ideas and halts the progress of others. Government is never the best positioned to choose winners and losers, that's why rules like the one proposed here should only be adopted when there is a concrete showing of harm, and no more narrowly tailored means to address it.

Lay-offs are increasing, funding for new initiatives is barely trickling in, and many companies are moving overseas where the regulatory burden is easier. This is not the time for the Commission to take radical steps that outlaw technologies and cut off areas of research. We ask that you take these issues into account as you decide how to proceed in this matter.

APPENDIX: LIST OF COMMENTERS

Aereal Inc.
Aereal Inc. manages a series of in-person events on behalf of the Ryze social network.
http://www.ryze.com
CONTACT: Adrian Scott, Ph.D., CEO and Founder
43 Edgewater Drive
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415-462-1850

Bauhaus Software
Bauhaus Inc. is a leading provider of software products and technologies to the digital visual effects market. Bauhaus' product line provides a suite of unique, comprehensive real-time software solutions for the creation and manipulation of animated graphics and special effects
http://www.bauhaussoftware.com
CONTACT: Dan Kraus, CEO
118 Broadway, Suite 317
San Antonio, TX 78205
210-212-7530

Bitfone Corporation
Bitfone's mProve™ is the wireless industry's first technology to update a mobile phone's core embedded operating system, over-the-air, in a secure and fault tolerant manner.
http://www.bitfone.com/
CONTACT: Gene Wang, CEO
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Laguna Niguel, California 92677
949-234-7000

Blossom Research
Blossom Research is an international consulting company. Currently, Blossom Research's main project is the development of GNU Radio, a toolkit that turns radio reception and transmission into software problems.
http://www.gnu.org/software/gnuradio/gnuradio.html
CONTACT: Eric Blossom, Founder and CTO
798 Lighthouse Ave., Suite 109
Monterey, CA 93940
831-224-3000

CEDX Corporation
CEDX is a network integration firm and VAR, specializing in network management and performance improvement with a wireline and WiFi ISP line of business. In operation since 1997, CEDX is emerging as a wireless networking leader in the N.Y. region.
http://www.cedx.com/
CONTACT: Craig Plunkett, CEO
22 Verleye Avenue
East Northport, NY 11731
877-906-8323

Damage Studios
Damage Studios Incorporated is the game studio that produces Rekonstruction, a next generation online multiplayer game, designed support over 1,000,000 concurrent users.
http://www.damagestudios.com
CONTACT: Chris DiBona, Co-Founder and VP of Marketing
22 Twin Peaks Blvd #2
San Francisco, CA 94114
415-462-3013

Dandin Group
The Dandin Group provides high speed Internet access to remote locations using advanced wideband wireless technologies. As an innovative leader in wireless Internet access, the Dandin Group Inc. (DGI) continues to push the technology to the new levels, dedicated to the belief that wideband wireless technology is the best prospect for connecting the world.
CONTACT: DeWayne Hendricks, CEO
43730 Vista Del Mar
Fremont, CA 94539
510-573-0561

Feedster
Feedster's innovative search technologies allow organizations and individuals to harness the rich quantity of information available as RSS feeds.
http://www.feedster.com/
CONTACT: Scott Rafer, President and CEO
3005 Clay St. Suite 1
San Francisco, CA 94115
415-867-5545

Gibeo LLC
Gibeo's products and services revolutionize content filtering and management at the network level.
http://gibeo.com
CONTACT: Jeremie Miller, Founder and President
417 2nd Ave SW
Cascade, IA 52033
563-543-0502

Lulu Enterprises, Inc.
Lulu provides the creators and owners of digital content with control over how they use and share their work. Individuals, companies, and groups can use Lulu.com to publish and sell a variety of digital content, including books, photos, images, and music.
http://www.lulu.com
CONTACT: Bob Young, Founder and CEO
3131 RDU Center Drive
Suite 210
Morrisville, NC 27560
919-459-5858

MySQL
MySQL develops and markets a family of high performance, affordable database servers and tools. MySQL is the world's most popular open source database, with more than 4 million active installations. Many of the world's largest organizations, including Yahoo!, The Associated Press and NASA, are realizing significant cost savings by using MySQL to power Web sites, business-critical enterprise applications and packaged software.
http://www.mysql.com/
CONTACT: Marten Mickos, CEO
2510 Fairview Avenue East
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425-743-5635

PEAK Internet
PEAK Internet LLC is a leading Oregon-based Internet Service Provider.
http://www.peak.org
CONTACT: Max Southall, CTO
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Corvallis, OR 97333
541-754-7325

Slim Devices
Slim Devices specializes in low-cost, easy-to-use networked devices. Our unique combination of elegant hardware and Open Source software has built an active worldwide community of users and developers.
http://www.slimdevices.com
CONTACT: Dean Blackketter, CTO
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SocialText
SocialText makes enterprise-level social software, enabling teams to communicate, collaborate and publish. Socialtext Workspace is the leading enterprise social software solution, adapting the best of wikis and weblogs for enterprise requirements and scale. Socialtext Eventspace is the leading social software for conferences. Socialtext Eventspace fosters community, enables virtual networking and self-organizing of content within a sponsorable space.
http://www.socialtext.com/
CONTACT: Ross Mayfield, CEO
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Solari, Inc.
Solari is an investment advisory company.
http://www.solari.com
CONTACT: Catherine Austin Fitts, Founder and President
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731-764-2515

Sputnik
Sputnik makes hardware and software products for managed Wi-Fi networks.
http://www.sputnik.com/
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Stonebrick Group
Stonebrick Group invests in technologies.
CONTACT: Auren Hoffman, Chairman
1328 Mission St, Suite 4
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Ted Roche & Associates, LLC
TR&A specializes in custom software development.
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CONTACT: Ted Roche, President
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603-746-5670

WeMatter.com
WeMatter.com is a position neutral "virtual town meeting" Internet hub site for learning and discussing issues, developing consensus proposals, and interacting with government.
http://www.wematter.com/
CONTACT: Mike Liveright
260 Byron St.
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WhizSpark Corporation
WhizSpark offers online event planning and promotional solutions using online social networking.
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CONTACT: Peter Caputa, President
44 Sagamore Road
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WiFinder
WiFinder, Inc. is the worldwide registrar of Wi-Fi hotspots. WiFinder helps anyone use and profit from Wi-Fi public access. WiFinder brings locations, services, and vendors an audience of high-speed public access Internet users that can not be so accurately targeted in any other way.
http://www.wifinder.com/
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